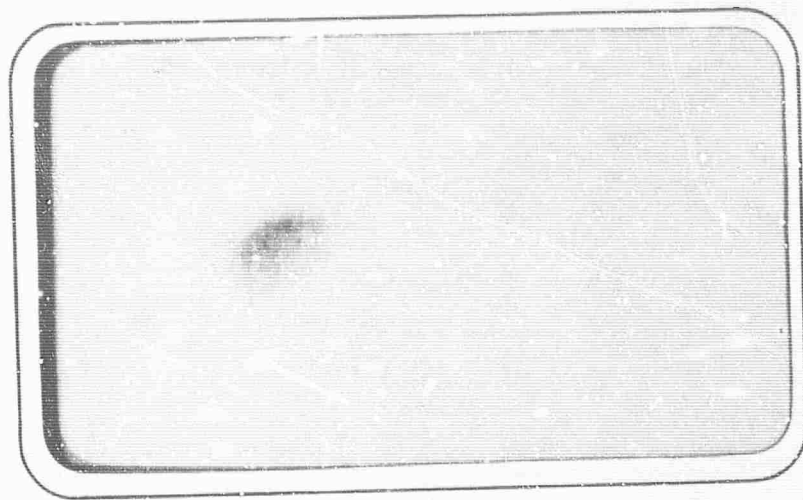


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Westinghouse

ELECTRIC CORPORATION

**SECOND QUARTERLY PROGRESS REPORT
SYNTHETIC SPECTRUM RADAR MODIFICATION
AND MEASUREMENT PROGRAM (U)**

Period of 1 October 1965 to 31 December 1965
Contract Number: DA-01-021-AMC-12384(Z)
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**A PROJECT DEFENDER RESEARCH TASK
SPONSORED BY THE
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SECOND QUARTERLY REPORT SYNTHETIC SPECTRUM
RADAR MODIFICATION AND MEASUREMENT PROGRAM (U)

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I. SUMMARY

During the past quarter the new building at the Liberty Dam Site has been completed. In addition, the fabrication and erection of the antenna and sixty foot reflector has been finished. All electronic cabinets and consoles with the exception of the transmitter hut have been moved to the new site and interconnecting cabling has been started. Work has continued during the quarter in conversion of data processing computer programs for use on the Defense Center Univac computer.

Several delays were encountered during the quarter. The building construction schedule slipped somewhat which delayed the movement of the equipment cabinets to the site. To overcome this, the necessary equipment modifications and cable layout were performed at a separate Westinghouse facility thus allowing this work to be performed in parallel. The supplier of the sixty foot reflector, Alpar Inc., went into bankruptcy and removed their construction crew from the site before the reflector was raised to the pedestal. This necessitated Westinghouse contracting for riggers and cranes to finally mount the reflector.

II. ANTENNA

A. Installation

During the past quarter all of the Huntsville portions of the STELLAR Antenna System have been installed at the Baltimore site. Structural modifications to the cone tower and barbette have been completed. Rewiring in the antenna area is approximately 80% complete.

The new 60 foot reflector and sub-reflector assembly have been completed and the reflector has been installed on the rotating assembly.

The skyworker has been installed and its usefulness already proved during the installation of the reflector.

Both the microwave receiver compartment and the feed cone are in their final positions on the antenna. Approximately eighty percent of their components have been installed.

The various stages of the erection are recorded in figures 1 through 10.

Servo hardware has been installed in the old Huntsville Reliance cabinet, a new servo cabinet, and in the Huntsville control console.

B. Hardware

Preliminary alignment and leveling of the antenna has been done. A mechanical analysis of the antenna structure indicated that the modifications that have been done (stiffening of the upper cone tower of the barbette) will raise the natural frequency to above 2.0 cps and reduce torsional and translational movements by a factor of 2.



Figure 1. Barrette Installed

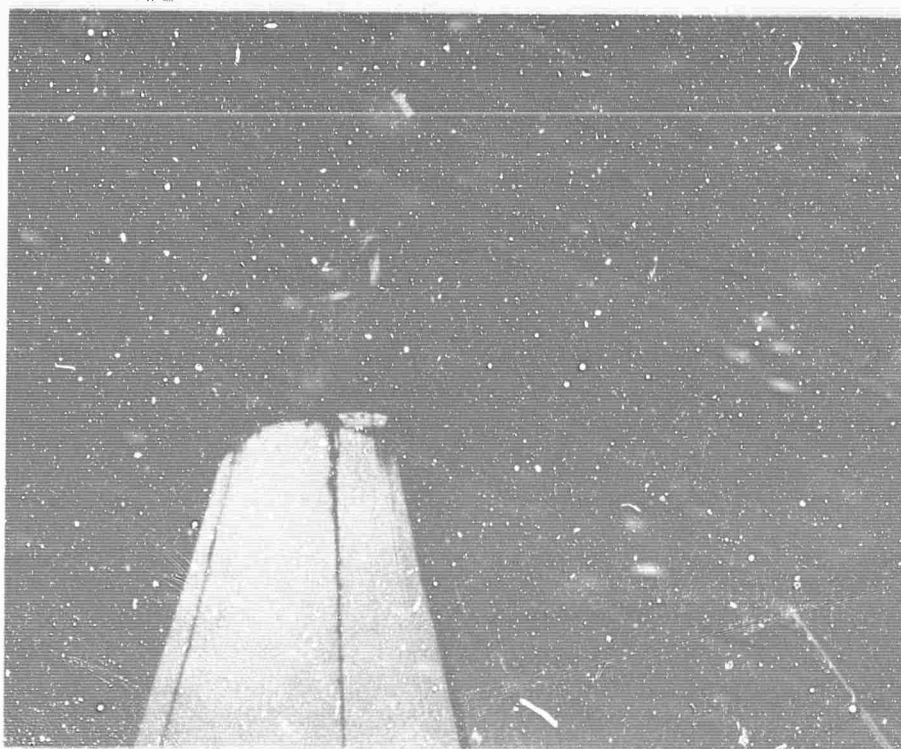


Figure 2. Upper Cone Tower Installation



Figure 3. Antenna Drive Mechanism Installation



Figure 4. Cherry-Picker Installation

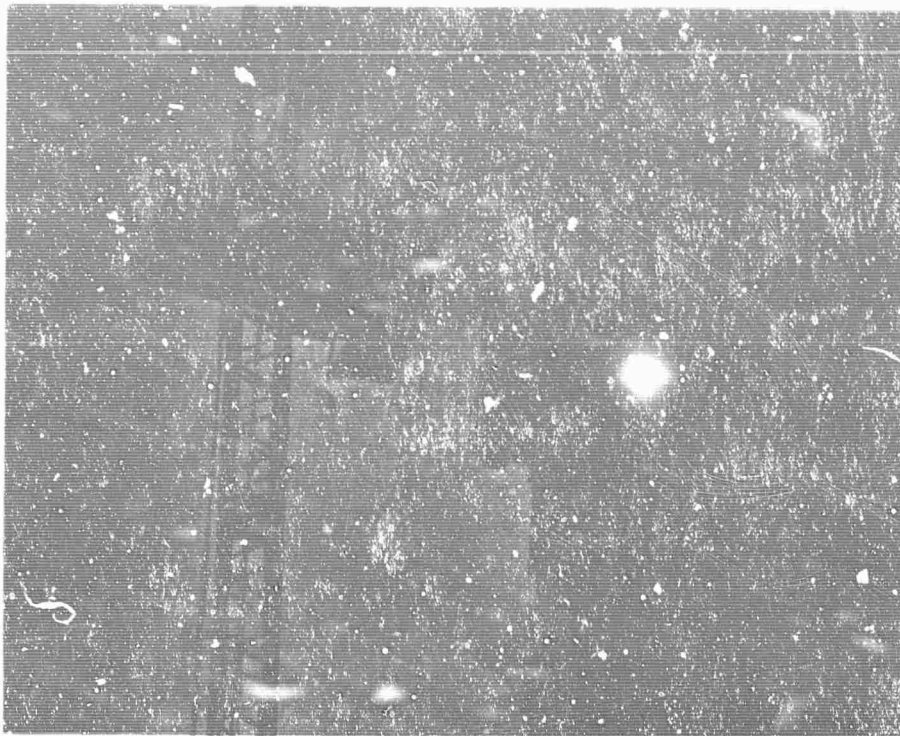


Figure 5. Counter-Weight Platform Installation



Figure 6. Torque Tube Installation

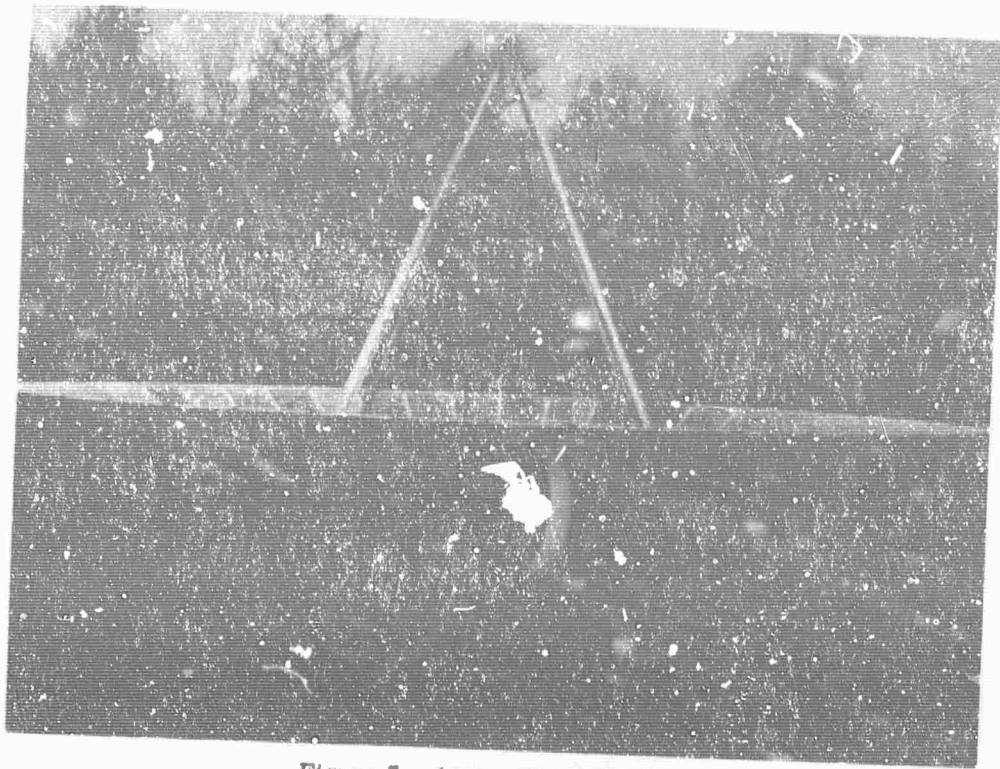


Figure 7. Assembled Reflector

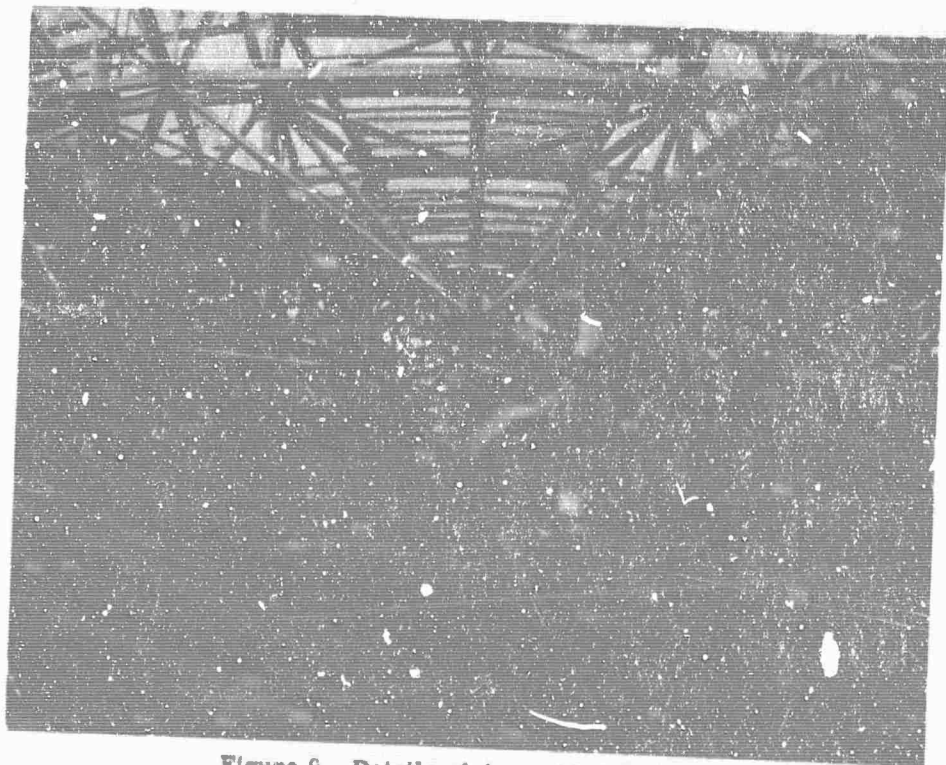


Figure 8. Details of Assembled Reflector



Figure 9. Raising of Reflector

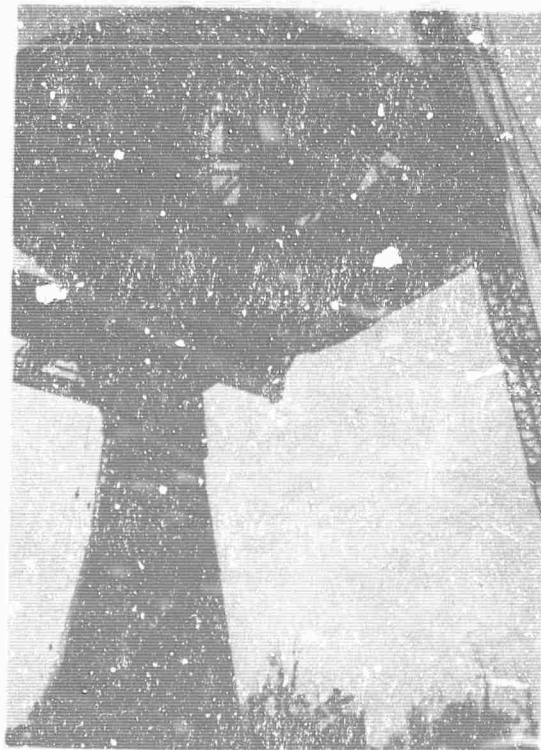


Figure 10. Antenna Installed

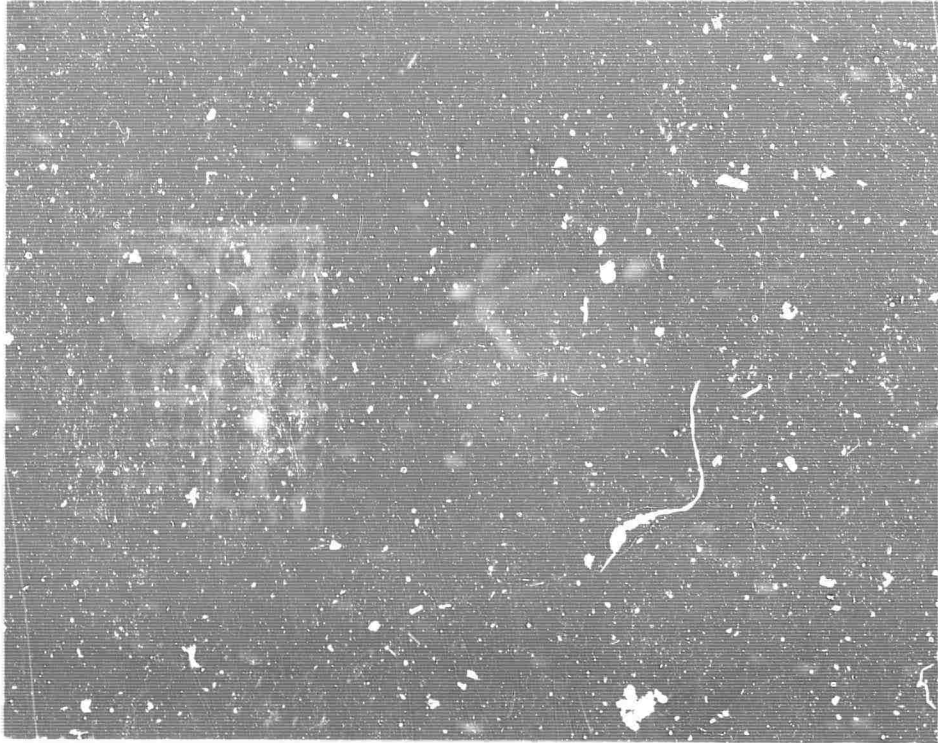


Figure 11. Display Console

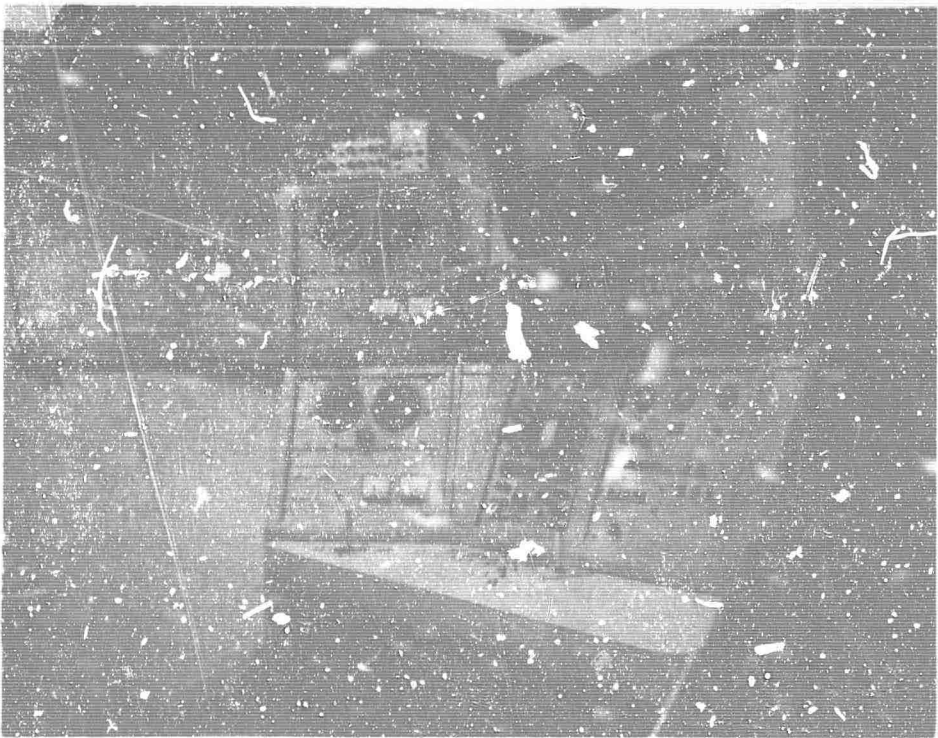


Figure 12. Control Console

A platform has been designed and installed on the skyworker tower for the Gun Director. In this position large sections of the horizon are useable for boresighting and balloon tracking.

Plans are being made to use the Baltimore TV tower for boresighting. It will provide a far field range with an adequate elevation to minimize ground reflections.

A monopulse four horn feed and comparator system has been fabricated and tested. The cassegrain sub-reflector is of fiberglass honeycomb construction with an embedded aluminum reflecting surface. The receiver compartment contains the low noise paramps and portions of the angle tracking receivers.

Modifications to the Reliance cabinet have been completed adapting the original power components to the new servo system. The new servo cabinet is approximately seventy-five percent complete. The servo panels of the control console are complete and ready for installation.

III. BUILDING AND ELECTRONIC EQUIPMENT

A. Installation

The equipment and office building as illustrated in the First Quarterly Progress Report was completed during this period. All equipment cabinets, the copper floor, cabinet plenums, cable raceways and air conditioning ductwork is now installed. Interconnecting cables are being installed and primary power is available at each cabinet via the main power distribution unit. Some equipment cabinets have been energized and are being functionally tested. The remainder will be tested during the next quarter.

B. Hardware

Transmitter

Fabrication and installation of transmitter components in the antenna equipment enclosure continued during this reporting period. The heat exchanger enclosure, also to be mounted on the antenna pedestal, has been completed and cooling equipment is being installed. It is still intended that the above units will be functionally tested "on the ground" prior to final installation on the antenna pedestal. The modified and repackaged exciter and driver units have been located in the equipment area and are ready for operation. The driver cabinet with its associated heat exchanger have been placed inside the antenna barbette structure in order to reduce the length of the waveguide run up to the transmitter.

Control and Maintenance Console

The control console has been completed with the exception of the transmitter control and monitoring panel wiring. The minor changes required on the Display Console are

completed and both consoles are positioned in the radar control room. Junction box wiring and cabling in the control room is nearing completion.

The Display and Control consoles are shown in figures 11 and 12.

Receiver-Bandwidth-Modification and Doppler Correction Circuits

The bandwidth filters and controls required in the Mode I range receiver and in the angle track receiver have been fabricated and installed. The $10 \text{ MC} \pm 250 \text{ KC}$ voltage controlled oscillator has been installed in the equipment and its frequency control voltage circuits fabricated.

Digital Range Tracker

The detail design of the digital range tracker was finished during this past quarter. Implementation of the wiring changes on existing equipment has been completed. Fabrication and implementation of new equipment is about 95% complete.

Checkout and functional test of this equipment has started. Checkout will be a severe task due to the very complex interrelationships throughout the equipment.

Programmed Acquisition

The effort to implement this system is split into two groups. That part associated with pre-flight calculation and preparation of a programmed acquisition, and that part associated with the real-time operation of this acquisition scheme.

A complete study of the equations necessary to develop the look angles and rates from orbital elements has been conducted and completed. A computer program to generate the necessary paper tape has been written and eighty percent checked out.

Detailed design of the equipment necessary for the real-time implementation has started and is about fifty percent complete.

IV. ANALYSIS

Data Processing

Conversion of existing data processing programs from the IBM 7094 to the UNIVAC 1107/1108 computer has continued. The two programs involved are the calibration program and the 2D Coherent Integration program. The programs have been converted from FORTRAN II to FORTRAN IV and the machine language subroutines have been converted from FAP to SLEUTH II. Debugging of these two programs is in progress.

Two other programs. Tape Conversion and Data Presentation, are being revised to conform to changes in data recording format at the radar site. These revisions are approximately fifty percent complete.

Smooth Track

The smooth track error analysis reported in the first quarterly report was completed and some of the results incorporated in a paper "Coherent Processing for Two Dimensions of High Resolution", which was presented at the GISAT symposium in December.

Preparation of computer programs to implement the smooth track phase reference with real radar data has continued. This work is about seventy-five percent complete.